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AUTHOR	Nachmias, Rafi; Ram, Judith; Segev, Limor; Mioduser, David
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ABSTRACT

The use of the Internet as an instructional tool in higher education is rapidly increasing. However, alongside the enthusiasm and creativity that generally accompany this process, essential questions regarding the learning quality and effectiveness of online courses emerge too. In order to answer these questions, a comprehensive research program is currently examining Virtual TAU--a campus-wide project aimed at integrating the Internet into the instruction of Tel-Aviv University's academic courses. This paper describes the research framework for the study of Virtual TAU, along with preliminary findings of the various studies at three levels: the macro level takes the instructional perspective on the diffusion process of the Internet within instruction on the campus; the mezzo level focuses on the character of teaching and learning processes emerging in Web-supported courses; and the micro level looks at the actual usage of the Web in the teaching and learning of specific courses. (Contains 20 references.) (Author)

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A Campus-wide Project of Web-based Academic Instruction: Research Framework and Preliminary Results

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Rafi Nachmias, Judith Ram, Limor Segev & David Mioduser

School of Education
Tel-Aviv University
Tel-Aviv, Israel 69978

nachmias@post.tau.ac.il ; judithr@post.tau.ac.il; limo@post.tau.ac.il; miodu@post.tau.ac.il

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Abstract: The use of the Internet as an instructional tool in higher education is rapidly increasing. However, alongside the enthusiasm and creativity that generally accompany this process, essential questions regarding the learning quality and effectiveness of online courses emerge too. In order to answer these questions a comprehensive research program is currently examining Virtual TAU – a campus-wide project aimed at integrating the Internet into the instruction of Tel-Aviv University's academic courses. In this paper we describe the research framework for the study of Virtual TAU, along with preliminary findings of the various studies at three levels: (a) the *macro level* taken the institutional perspective on the diffusion process of the Internet within instruction on the campus; (b) the *mezzo level* focuses on the character of teaching and learning processes emerging in web-supported courses; and (c) the *micro level* looks at the actual usage of the web in the teaching and learning of specific courses.

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Introduction

The use of the Internet as an instructional tool in higher education is rapidly increasing. In the last decade, introduction of this new technology in higher education has generated a rich variety of teaching configurations (AFT, 2001; Bates, 2000; Bonk, Cummings, Hara, Fischler & Lee, 1999; Collis & Moonen, 2001; Harasim, Hiltz, Teles, & Turoff, 1995; Mason, 2000; Mioduser & Nachmias, 2002). These range from the incorporation of web technology into existing face-to-face courses as an additional information-support tool, to the development of complete distance learning courses.

To look at the impact of these developments within the context of higher education implies, in fact, to examine the ways they challenge the 2,500 years old Socratic, face-to-face instruction modes characterizing most college and university teaching. However, alongside the enthusiasm and creativity characterizing this process, essential questions regarding the learning quality and effectiveness of online courses emerge (e.g, AFT, 2000; Guri-Rosenblit, 2001; Phipps & Merisotis, 1999). To answer these questions comprehensive research, is currently being conducted into Virtual TAU – a campus-wide project aimed at integrating the Internet into the instruction of Tel-Aviv University's academic courses. In this paper we describe the research framework along with preliminary findings.

The Virtual TAU Project

Tel-Aviv University (TAU) is one of the largest research universities in Israel. Located in the center of the country, it serves about 27,000 students annually. These students are enrolled in about 6,000 courses which are taught by about 4,000 instructors in almost every academic discipline.

The Virtual TAU project at Tel-Aviv University (http://virtual.tau.ac.il) was launched in the academic year 2000/01, in response to a government initiative to prompt advanced learning technologies in Israeli higher education. The project aimed to initiate and catalyze a process by which gradually more

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faculty members use the Internet to enrich learning processes and to make instruction more efficient and flexible.

The web-shell used by Virtual TAU is *Highlearn*, a novel Internet course management system. Similar to other web-supported course systems (e.g., *Blackboard*, *WebCT*, *Lotus Learning Space*), *Highlearn* allows easy creation of an information base for the course content and didactic activities, and supplies both synchronous and asynchronous communication tools for students and instructors. In addition, it provides tools that assist the instructor in administrating the course (e.g., course scheduler, address book).

One of the fundamental principles of the project is that the instructors, most of them TAU faculty, maintain full responsibility for the course's website. Their views regarding the objectives, syllabus, and instructional methods lead the development and the implementation of the course. No pre-designed pedagogical solution are imposed. Rather, each instructor acts according to his or her own pedagogical approach. Most of the projects' activities are aimed at empowering the instructors, helping them in the realization of their pedagogical vision.

The Study Of The Virtual TAU Project

One major objective of the research design is to evaluate the potential of the web-supported courses and to examine the conditions needed to realize this potential. The research framework of Virtual TAU consists of three levels of analysis. First is the *macro level*, which focuses on the assimilation process of the Internet into the campus instruction from the institutional point of view. Second is the *mezzo level*, which focuses on the character of teaching and learning processes emerging in the web-supported courses. Finally is the *micro level* concerns the characteristics and consequences of the actual usage of the web features for teaching and learning purposes in specific courses. A detailed description of the research framework can be found in Nachmias, 2002.

Macro Level: The Assimilation And Diffusion Process

Questions asked at this level relate to the characteristics of the assimilation and diffusion process of the new technology, and to the factors affecting this processes. Rogers (1995), who contributed a widely accepted conceptual framework for the understanding of diffusion of innovation process, views organizations (e.g., universities) as social systems composed of individuals with varying degrees of openness to technological innovation. The rate at which an innovation is adopted within an organization is a function of certain characteristics of the organization's staff, the innovation itself, and the information disseminated about it. An innovation will be more easily adopted if the potential users are convinced that there is some advantage in using it, and if the innovation is compatible with their current needs and values.

The major research questions asked at the macro level are: Does the diffusion of the Internet in the TAU campus follow Rogers' model? What is the profile of the Tel-Aviv University staff members who have adopted the Internet in their academic instruction? What are the factors (e.g., central support, staff development) affecting successful integration of the Internet in instruction? What are the barriers diffusion (e.g., lack of incentive, instructor's reluctance due either to personal teaching style or to negative attitude towards ICT, limited infrastructure)?

Data collection at the macro level is being carried out every semester on each of the participating courses and their instructors. These instructors are asked to fill out a questionnaire regarding personal information (e.g., gender, position, ICT experience), their needs, and their perception of the contribution of the innovation to the students' learning. A sample of instructors and decision makers are interviewed as well.

Mezzo Level: Shifts in Instruction and Learning

The mezzo level deals with general learning and teaching patterns of students and instructors using Virtual TAU. These patterns are examined in five major domains:

Time/Space Configuration

Information and communication technologies (ICT) challenge the traditional definitions of rigid space and time slots (e.g., access anytime from anywhere). This domain refers to how, and to what extent, the Internet has made academic instruction more flexible in temporal and spatial terms. To answer this question a random sample of about 300 course websites (out of about 1000 courses in the year 2002) is being reviewed and analyzed using a *course website characterization scheme* developed for this purpose.

Information and Content

Content is the major ingredient of any course website (Bonk, 2001). While studying the course, students use various content resources included in the website (e.g., presentations, textbooks, papers, links to other websites, lecturer notes, readings). It is natural that instructors invest considerable effort in planning and developing their course website's contents. Given that a complete overlap between the developers' vision of the course website and the students' usage of it is impossible, it is important to assess the contents consumption patterns (e.g., Sason & Nachmias, 1999). The research objectives in this domain were to assess the extent to which (a) instructors upload contents on their websites, and (b) these contents are consumed by students. Using the data collected in this study, we aim to come up with possible statistical measures of courses' "content consumption". Data was directly collected from computer logs of about 5000 students in 117 courses using Virtual TAU in the academic year 2000/01. Page views for every content unit by every student were recorded and analyzed.

Communication and Interaction

In this domain we are interested in the extent and quality of students' and instructors' communication behavior supported by synchronous and asynchronous communication tools. A typical use of ICT tools in web-based learning is the asynchronous discussion forum. Such a tool provides students with the opportunity to communicate, share ideas and collaborate (e.g., Hara, Bonk & Angeli, 2000). The technical feature that enables storage and accumulation of all participants' contributions allows both students and instructors to review previous interactions and to reflect on different aspects of the learning process within the forum. The major research questions are: To what extent do instructors use forums in their course websites and for what purposes? What are the individual differences among students in forum usage? To answer to these questions, about two hundred courses in the academic year 2000/2001 were screened. Then, we analyzed the messages of all 994 students who studied in 34 courses who used forums extensively, and interviewed students and teachers as well.

Pedagogical and Didactic Solutions

From the pedagogical perspective, innovations are defined in terms of novel didactic solutions reflecting theoretical shifts (e.g., from a behaviorist to a constructivist perception of the learning process). The properties of ICT raise the need to examine fundamental questions regarding the desired features of pedagogical models using web technology (Mioduser, Nachmias, Oren & Ram, 2000), in hybrid face-to-face/virtual courses (Nachmias, Mioduser, Oren & Ram, 2000) or in online discussion groups (Oren, Mioduser & Nachmias, 2002). Research seeks to identify and classify the evolving web-pedagogies ("webagogies") and assess their usage and their effectiveness (e.g., Stephenson, 2001). The primary objective of this study is to identify, collect and classify exemplary pedagogical practices used by selected instructors participating in Virtual TAU (e.g., innovative educational activities, assignments, and didactic solutions). These all are being added to the "webagogies data-base" which will eventually be disseminated throughout the campus. Web-pedagogies are identified and classed through the analysis of the courses' websites, as well as via interviews with their developers and instructors.

Student And Teacher Roles

Increased delegation of responsibility and control over the learning process to the students is one result of the web-based pedagogical innovations. They might promote active and independent learning in which students take responsibility for their own learning, set their own learning goals, create their own learning activities, and/or assess their own progress and/or the progress of other students. ICT might engage students in collaborative, project-based learning in which they work with others on complex, real-world problems or projects. ICT also might provide students with individualized instruction, customized to their different entry levels, interests, or conceptual difficulties (Kozma, 2000). A major research question is whether all this potential is realized in the learning process. Another question is related to students' attitudes toward their use of the Internet for learning and their perceptions of the technology usage. To answer these questions about 3,000 students using Virtual TAU filled out a questionnaire designed for the study. Changes in teachers' role is also a substantial subject for research. Is the shift from "a sage on the stage" to "a guide on the side" a realistic one? Is such shift to be expected from all teachers given their various teaching styles and needs? These and similar questions are currently being answered by a sample of 50 lecturers participating in this study. Data are being collected by means of interviews in two phases: during the first year of usage by the lecturer and two years later.

Micro Level: Features of the Teaching/Learning Process in Specific Courses

At this level we are interested in the actual features and consequences of particular teaching/ learning processes and of explicit behaviors of instructors and students in specific courses. Several studies are being conducted. The first study focused on the emergent collaboration activities in six graduate courses using Virtual TAU. Emergent collaboration is the process by which group configuration and transactional patterns evolve among participants in the course of learning. The major research questions were: What are the didactic modes that have been devised for supporting emergent collaboration learning processes, and to what extent do students and teachers participate in these processes? Data were collected by means of log files of students' page-views within Virtual TAU, transcripts of forums and collaborative activities, and unstructured observations. A description, results and conclusions of this study have already been published (Nachmias, Mioduser, Oren, & Ram, 2000).

A second study examined whether social climate evolves in different types of on-line courses. The study compared a hybrid course (involving a mixture of online and face to face interactions) and a distance learning course with reference of the emergence of a social climate. This study focuses on the content analysis of messages posted by the students (a detailed description can be found in Oren et al., 2002).

IN ADDITION TEN COMPREHENSIVE COURSE CASE-STUDIES ARE BEING CONDUCTED WITH THE AIM TO PROVIDE MICRO-LEVEL INFORMATION REGARDING THE ACTUAL IMPLEMENTATION OF THE INTERNET IN THE INSTRUCTION (FIVE DURING THE ACADEMIC YEAR 2001/2002, AND FIVE MORE IN 2002/2003). Data collection is done a variety of instruments (e.g., instructor interview; class observation; student interviews; analysis of the course's website, and learning products).

Preliminary Results

Since most of the studies are still at the data collection stage, we describe only some major results.

At the macro level we observed that the project expanded very rapidly beyond any expectation. At the planning phase of the project we intended to implement the web shell in 100 courses over a two-year period, providing each one with a small budget and technical and pedagogical support. Actually, the number of courses in the project increased to 252 in the first year of the project, and in the current academic year (2001/2002) more than 400 instructors and more than 10,000 students from all faculties are using Virtual TAU in almost 1,000 courses. Only 100 courses are receiving financial support from the university. This suggests that the instructors realize the potential benefits of the novel technology for teaching, and are willing to invest their own time and resources in using it. Moreover, many instructors who previously developed course websites using various HTML editors, abandoned these tools and rebuilt their websites using the Virtual TAU shell. This implies that a uniform, easy-to-use, web-supported learning environment is the right tool in the right place for many instructors.

At the mezzo level, several phenomena were revealed. Flexibility in learning time and space was not really achieved so far. Less than 1% of the courses were implemented as complete distance education courses and very few instructors replaced face-to-face classes by web assignments. In the vast majority of the courses the web activities were additions to the ordinary classes. Most instructors view the Internet as content provider rather than a communication facilitator. While all instructors uploaded content to their websites (average of 28 items per website, sd 25), only in 16% of the courses asynchronous forums were included as a teaching mode. Content items include presentations, articles, academic papers, links to websites, simulations, assignments, tests, answer sheets, etc.

From the pedagogical point of view most instructors are using the websites in a basic fashion. Only about five percent are developing and using novel pedagogies in which the web has clear added-value (e.g., web-supported collaborative work, replacing face-to-face instruction, web self-test, web peer review). Other instructors (an additional 5-10%) are experimenting and adding new features to their websites in successive runs of their courses (e.g., adding discussion group activities, developing self-tests for students).

As regards to students' usage of the course websites, which in most of the cases were complementary to face-to-face instruction and not obligatory, we found partial and limited usage of the digital medium. For example, out of 5,015 students enrolled in web-supported courses, 1,938 students (38%) did not view *any* content item on the courses' website. Out of 994 students enrolled in courses using asynchronous forums, 478 students (48%) did not participate *even once* in the discussions. These figures

are considerably large even taking into account that they include students who dropped the courses, and that many technical problems occurred in the first year of the implementation.

Of those students who did use the course website, many did not realize its full potential. For example, 70% of the students accessed less than half of the content items, and less than 5% accessed all content items in a course's website. Figure 1 shows the distribution of the percentage of content items viewed by students in 117 courses. A similar picture was obtained regarding the usage of asynchronous forums, where a few students dominated the discussions.

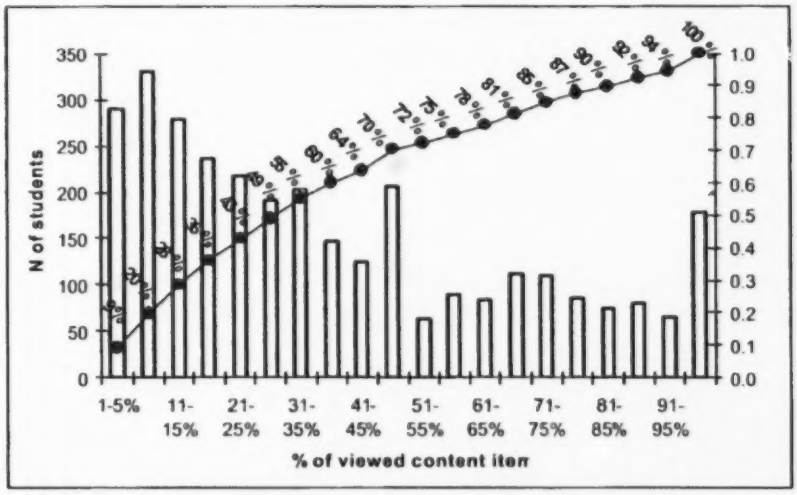
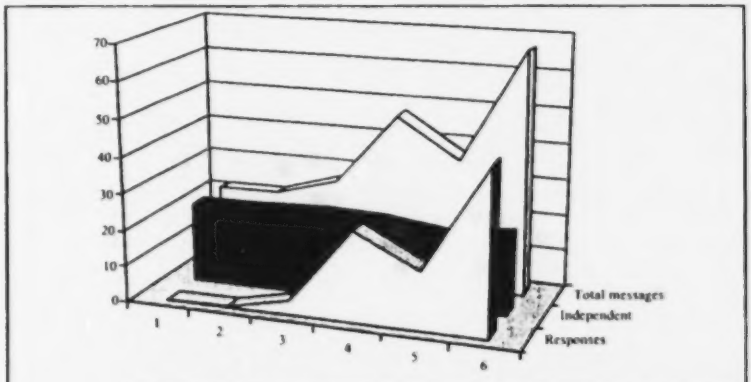


Figure 1: the distribution of the percentage of content items viewed by students(n= 117 courses)

At the micro level specific courses and particular educational transactions were investigated. For example, in one graduate course at the School of Education, critical reading activities were devised as Web-supported and collaborative tasks. Web-support took two main forms: most reading materials were located (as full text and in digital form), or could be reached, in Websites; and Web-shell tools (e.g., forums, mail) supported the students' work. Collaboration was implemented not in the form of pre-structured collaborative tasks, but as working milieu within which learning transactions and dynamic partnerships were expected to evolve in the course of the semester. Figure 2 shows the evolvement of the transactional volume in quantitative terms. The course (22 students) included six forums focusing on critical-reading tasks. For the first two forums, each student entered one message, according to the minimal requirements. By the fourth task participation had increased notably, up to a triplication of the initial values in the last task. The interesting aspect of these figures is that the number of independent contributions remained the same for all tasks, while the difference was made by the increasing amount of responses to other students' messages – from none at the beginning up to 45 in the last task (See Nachmias et al., 2000 for more details).



	1	2	3	4	5	6
Responses	0	0	4	25	16	45
Independent	22	22	23	22	20	22
Total messages	22	22	27	47	36	67

Figure 2: Number of transactions in six forums of a graduate course using Virtual TAU

A similar observation was made in an undergraduate course in life sciences. This course created specifically for distance learning, aimed to promote critical reading of scientific articles. The core content of the course comprised six scientific articles which the students were required to read, analyze, discuss and criticizeusing the asynchronous tools. Bothinstructor and students reported on an outstanding learning experience involving autonomous learning and collaborative work.

Final Remarks

This paper described the comprehensive research framework for a campus-wide implementation project aimed at integrating the Internet into the academic instruction. The data excerpts presented illustrate the complexity of the project and the many faces of its evaluation. On one hand, we saw enthusiasm and clear evidence of the educational potential of web-supported instruction. On the other hand it is obvious that most instructors and many students still have a long way to go in realizing this same potential. We view this comprehensive research effort as an essential part of the process of change in academic instruction. The research results (primarily at the micro and the mezzo levels) might assist instructors in their continuous efforts to improve their instruction. Updated data and just-in-time insights (primarily at the macro level) can support university leaders and decision makers in managing the technological change in the institution. And finally, research at all levels contributes to the growing body of knowledge about web-supported learning and teaching processes.

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